DEVICE AND METHOD FOR EXTINGUISHING A CANDLE FLAME

Technical Field:

This invention relates to devices and methods for extinguishing candles, and more particularly to devices and methods that utilize a fine aqueous mist to extinguish the candle flame.

Background Art:

Devices for snuffing out candles have been known for hundreds of years. These devices essentially comprise an elongate handle with a cup or bell-shaped housing on one end that is placed over the candle flame to deprive it of oxygen and snuff out the flame.

In spite of their effectiveness in snuffing out the flame, conventional candle snuffers fail to prevent the candle from smoking after the flame is extinguished. This smoke is produced as a result of burning of the wick. During the time a candle flame burns, the liquefied tallow or wax material of the candle is drawn upwardly through the wick, and it is this liquefied material that burns. When the flame is extinguished with conventional candle snuffers, the wick itself burns and smolders for a short period of time, producing undesirable smoke and soot and damaging and shortening the life of the wick. Conventional candle snuffers are not operable to reduce the temperature of the wick sufficiently to prevent it from burning and smoldering for a short period of time after the flame is extinguished.

United States patent 6,267,581 to Harrison addresses this problem by combining a conventional candle snuffer with means for producing a mist of water to suppress the production and dispersion of smoke from the wick. According to the disclosure in this patent, the candle snuffer is operative to work as a conventional snuffer, as well as to impart a scrubber-type function, namely, extinguish a candle flame while removing or otherwise preventing smoke from entering and dispersing into the surrounding atmosphere (column 3, lines 58-62). The quantity of water discharged upon operation of the pump, and the pressure and droplet size of the mist are not disclosed. Thus, it is not clear whether the quantity and nature of the mist produced by this device would be capable of extinguishing the candle flame if the snuffer were not used, or if the quantity and nature of the mist might be capable of wetting and damaging furniture or other

materials adjacent the candle, or for that matter, whether the device disclosed in this patent is operative to completely prevent burning of the wick after the flame is extinguished. Further, the device disclosed in this patent has some of the same disadvantages as conventional candle snuffers, e.g., molten wax from the candle may adhere to the snuffer when it is used.

Accordingly, there is need for a simple and inexpensive device and method that utilizes an aqueous mist to extinguish a candle flame and prevent burning of the candle wick after the flame is extinguished, without wetting and potentially damaging adjacent furniture or other accessories, and without necessitating contact between the device and the candle.

Disclosure of the Invention:

The present invention comprises a device and method that utilizes an aqueous mist to extinguish a candle flame and prevent burning of the candle wick after the flame is extinguished, thereby avoiding the production of smoke and prolonging the life of the wick.

The device of the invention produces a spray of aerosolized water that is directed against the flame and wick of a burning candle to extinguish the flame and cool the wick without saturating it, and without requiring contact or near contact with the candle. The spray has a predetermined spray pattern and droplet size and is at a predetermined pressure to extinguish the candle flame and prevent burning of the wick without causing wetting and potential damage to adjacent furniture and accessories, and without saturating the wick with water.

A finger pump, trigger sprayer, pressurized aerosol dispenser, or other apparatus may be used to produce the spray, in which the water droplets have a size distribution from about one up to about one thousand microns, with a very steep bell curve. For extinguishing candles typically found in the home, the average droplet size preferably is from about sixty-five to about seventy microns.

Further, in a preferred construction the device dispenses a metered quantity of water sufficient just to extinguish the flame and prevent burning of the wick. Finger pumps, for instance, may be constructed to dispense only up to 0.50 ml with each dispensing cycle, although just .08 ml of water is preferred. Similarly, trigger sprayers may be constructed to dispense only up to about 0.50 ml of water in each dispensing cycle.

Additionally, the device of the invention is constructed to produce a conical spray pattern that is filled (not hollow in the center) and has a diameter of approximately two to three inches at a distance of about four or five inches from the spray nozzle. This spray pattern results in concentration of spray over a limited central area at a limited range, whereby the amount of over spray is minimized and the amount of spray directed against the flame and wick is maximized.

To produce the desired spray pattern, an orifice size of from 0.10 to 0.25 inch preferably is used in a mechanical break up nozzle to produce a full spray. In mechanically pressurized devices, e.g., finger operated pumps, a .012 inch mechanical break up insert may be placed in a Santos button, available from Precision Valve Corporation of Yonkers, New York. Pressurized aerosol dispensers used in the invention are designed to produce a pressure of from about 25 to about 100 psig, and use a .013-inch MBST actuator, also by Precision Valve.

A pressurized aerosol dispenser according to the invention may use air, nitrogen, argon, carbon dioxide, or other suitable gas as the propellant. Carbon dioxide (CO_2) is particularly suitable, because as an inert gas it tends to deprive the flame of oxygen and extinguish the flame even in the absence of water. Thus, when CO_2 is sprayed from the dispenser it can be effective in helping to extinguish the flame, while the water sprayed from the dispenser can be effective both in extinguishing the flame and in cooling the wick to prevent it from burning and smoking when the flame is extinguished.

An aerosol dispenser that sprays a mixture of CO_2 and water can be designed to produce a light, fog-like mist containing very small droplets and bubbles and that is particularly effective as a flame extinguisher. A surfactant can be added to the product to enhance this effect by causing a very light foaming action. A small quantity of the foam can lightly cover the wick to assist in preventing burning and smoking of the wick after the flame is extinguished.

Further, the water used in the sprayer of the invention can be de-ionized and/or de-mineralized to minimize spotting or other damage to surfaces of furniture, accessories, and the like that may be contacted by the spray.

The sprayers used in the various forms of the invention can be of simple, economical construction, and can utilize conventional sprayers, e.g., a Precision Valve Corporation P4-1 pump modified as necessary to incorporate the inventive features discussed herein.

Brief Description of the Drawings:

The foregoing as well as other objects and advantages of the invention will become apparent from the following detailed description when considered in conjunction with the accompanying drawings, wherein like reference characters designate like parts throughout the several views, and wherein:

Figure 1 is an exploded perspective view depicting a candle being extinguished with a finger pump type sprayer according to the invention.

Figure 2 is a side view in elevation of a trigger-actuated sprayer according to the invention.

Figure 3 is a side view in elevation of a pressurized aerosol dispenser according to the invention.

Figure 4 is an enlarged, longitudinal sectional view of a pressurized aerosol dispenser according to the invention, wherein a CO_2 propellant is used to pressurize and dispense the water, and a carbon material block in which a quantity of CO_2 has been adsorbed is placed in the container to replenish the CO_2 and maintain a desired pressure in the container as the product is used.

Figure 5 is a fragmentary view similar to figure 4, depicting a modification in which a quantity of gas adsorbent material is contained in a pouch to store a quantity of CO_2 that is released to maintain pressure in the container as product is depleted.

Best Mode for Carrying Out the Invention:

With reference to figure 1, a first form of the invention is indicated generally at **10**, wherein a finger pump type dispenser **11** is used to pressurize and dispense water as a fine mist or spray **12** onto the flame **F** and wick **W** of a candle **C** to extinguish the flame and cool the wick to prevent burning of the wick and the concomitant production of smoke. The dispenser **11** may comprise an economical conventional design, modified to incorporate the inventive features therein, i.e., a mechanical break up nozzle to produce an aerosolized, conically shaped full spray of water having a diameter of about 2-3 inches at a distance of about 4-5 inches from the nozzle, and very small droplets having a size range of from about 1 micron up to about 1,000 microns,

distributed over a very steep bell curve. Preferably, the average droplet size is in the range of from about 65 to about 70 microns.

To produce the desired spray pattern and preferred droplet size distribution, a .012-inch mechanical break up insert **13** is placed in a Santos button **14**, both available from Precision Valve Corporation of Yonkers, New York. The pump **11** shown in figure 1 may comprise this type of pump.

A metered quantity of water sufficient just to extinguish the flame and prevent burning and smoking of the wick may be sprayed by the dispenser. One suitable pump is the .08 ml dosage P4-1 pump, available from Precision Valve Corporation. The pump **11** shown in figure 1 may comprise this type of pump.

Details of the insert, button and dosage pump are not provided herein since those elements can be readily identified and obtained from Precision Valve Corporation to practice the invention as described herein. In this regard, it should be understood that suitable equivalent structures also may be available from other sources.

In use, the sprayer of the invention is held a suitable distance from the flame, e.g., about 4 or 5 inches, and the pump depressed to direct an aerosolized spray of water against the flame and the wick to extinguish the flame and to cool the wick to prevent burning and smoking of it. The characteristics of the spray are such that it substantially dissipates before it can strike the surface of furniture or other accessory adjacent the candle.

A variation of the invention is indicated generally at **15** in figure 2, wherein an economical conventional trigger actuated dispenser **16** is modified to incorporate a .012 mechanical breakup insert **13** and a metering chamber (not shown) having a small volume, e.g., up to about 1.0 ml. This form of the invention operates to produce a high-pressure spray with very small water droplets, essentially as described above in connection with the figure 1 embodiment, and to avoid duplication is not further described herein.

A third variation of the invention is indicated generally at **20** in figures 3 and 4. In this form of the invention, a pressurized aerosol dispenser **21** is used to produce the aerosolized spray for extinguishing the candle flame and preventing burning and smoking of the wick. The dispenser **21**may be of economical conventional construction modified to produce the spray characteristics discussed above in relation to figure 1, e.g., an aluminum container **22** (CCL

Industries) having a 1 inch aerosol valve **23** with a 0.013 inch orifice (.013-inch MBST actuator by Precision Valve Corporation), a 0.010 inch vapor tap, a 0.060 inch body orifice, a dip tube **24** of appropriate length, and a pressure in the container of 25 to 100 psig.

Air can be used as the propellant in the pressurized aerosol dispenser **21**, but it is preferable to use any suitable inert gas that does not support combustion, e.g., argon, nitrogen, or carbon dioxide.

Carbon dioxide (CO_2) is shown being used in the aerosol dispenser in figures 4 and 5. In the embodiment shown in figure 4, a cohesive block or body **30** of gas adsorbent material in which a quantity of CO_2 has been adsorbed by exposure to a pressurized atmosphere of CO_2 is placed in the container. Although the block **30** is shown as having a disc shape, it should be understood that the body can have any desired operable shape.

In the figure 5 embodiments, a quantity of the gas adsorbent material is contained in a pouch or membrane **31** that is permeable to the gas.

The gas adsorbent material in either form of the invention may comprise granular activated carbon (GAC), Zeolite, or other gas adsorbent material or compound. One suitable material comprises a synthetic form of Zeolite known as MOLSIV (molecular sieve) type 13X-A, available from UOP in Alabama. Another synthetic form available from UOP is referred to as M5D5 13X 10x20.

A quantity of water **32** is introduced into the container, and CO_2 (or argon, nitrogen or other suitable gas) is then pumped into the container to fill the remaining space, whereby the water occupies 2% to 50%, by volume, of the space, and the gas occupies the remaining space, i.e., 98% to 50%, by volume. As the product (water) is depleted from a conventional aerosol dispenser, there is a reduction of the pressure in the container. However, as the water is depleted and the pressure decreases in the invention, additional CO_2 is released from the gas adsorbent material, e.g., the block of carbon **30** or the pouch **31**, to restore the volume of gas and thus maintain the pressure in the container. The amount of CO_2 adsorbed in the gas adsorbent material is sufficient to maintain the desired pressure in the container until all the product (water) is depleted.

In a preferred embodiment, a small portion of the CO_2 is discharged through the vapor tap in the aerosol valve and mixes with the water to generate a very fine bubbling reaction,

producing a fog-like discharge of water and CO_2 consisting of very small droplets and bubbles that is very effective in extinguishing the flame.

A surfactant may be added to the water to enhance this effect and cause a very light foaming action. In this variation, a minute quantity of the foam would adhere to or very lightly coat the wick to enhance the action of the spray in avoiding burning and smoking of the wick after the flame is extinguished.

The water in all forms of the invention may be de-ionized and/or de-mineralized to minimize or avoid spotting or other damage to surfaces that might be contacted by the water when it is used to extinguish a candle flame.

Although particular embodiments of the invention are illustrated and described in detail herein, it is to be understood that various changes and modifications may be made to the invention without departing from the spirit and intent of the invention as defined by the scope of the appended claims.

WHAT IS CLAIMED IS: